CONSTRUCTION
CRAFT LABORER

JOB OPPORTUNITIES
IN THE
ENERGY SECTOR

MAY, 2012
From manufacturing facilities to professional offices and from retail establishments to homes, energy powers every business sector: there is no single industry that is more central to economic growth and jobs. This paper investigates where Construction Craft Laborers (CCLs) can find those jobs and the skills they’ll need to succeed in them.

In this paper we’ll describe:

1. Different types of energy production and distribution sectors,
2. Job opportunities for CCLs in each industry sector,
3. Available LIUNA training that prepares CCLs for those jobs.

When discussing jobs and LIUNA training programs, we address the three basic energy industry sectors: transmission and distribution, renewable energy sources, and traditional energy sources.

Transmission and Distribution involves building plants and maintaining the country’s aging electrical grid.

The Renewable Energy sector includes solar, wind, geothermal, bioenergy and hydropower. As cleaner energy sources gain traction, job opportunities here are particularly exciting.

Jobs and training for the Traditional Energy sector include natural gas and nuclear energy plant construction, expansion and maintenance.

Additional opportunities in environmental building and clean energy are included in the Going Green section.

Generally, a high school diploma and industry training are required for the jobs discussed here. To successfully complete LIUNA training programs, a worker must attend the entire course, attain an 80 percent or better on the written exam, and correctly perform all steps of the practical assessment.

Why LIUNA Training?
We developed this paper to help meet the challenge of creating a robust energy sector workforce. As the training fund of the Laborers’ International Union of North America, we develop industry skills standards, create the courses, train the trainers, and work together with 70 affiliated LIUNA Local training centers located throughout the United States and Canada to respond to ever-evolving industry needs. With LIUNA Training programs, workers know they’ll benefit from rigorous hands-on training; and employers know a LIUNA trained worker has the skills, aptitude, and knowledge necessary to perform safely and productively.
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Demand for energy will not ease any time soon. ENERGY STAR, the joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), reports:

+ Global demand for all energy sources is forecast to grow by 57 percent over the next 25 years.
+ U.S. demand for all types of energy is expected to increase by 31 percent within 25 years.
+ U.S. electricity demand alone will grow by at least 40 percent by 2032.
+ New power generation equal to nearly 300 (1,000MW) power plants will be needed to meet electricity demand by 2030.

Continuing energy growth also generates a need for trained and skilled workers. In fact, the energy industry fueled some of the fastest job growth in the U.S. in 2011. According to a national employment report on job growth released in fall 2011, two counties in Pennsylvania saw job growth of more than 4.2 percent while the national average was 1.3 percent. Part of this growth was fueled by Marcellus shale natural gas extraction - an important new energy resource. (Source: Pittsburgh Tribune Review via marcelluscoalition.org)

The demand will continue for workers trained in the skill sets that energy jobs require. According to the U.S. Bureau of Labor Statistics’ 2010-11 Career Guide to Industries:Utilities, earnings for utility production workers are significantly higher than in most other industries.

The number of jobs in America’s emerging clean energy economy grew nearly two and a half times faster than overall jobs between 1998 and 2007, according to a 2009 report released by The Pew Charitable Trusts. Over the past few years, hundreds of thousands of people found work due to DOE and Recovery Act economic stimulus programs which create jobs and conserve or generate energy. Long term national energy goals, such as updating the national power grid and making commercial buildings more efficient, will also create jobs and spur investment.

“Tax credits directly fund, among other things, construction and manufacturing jobs to build the facilities and components needed to meet energy goals. Grants fund research into new and innovative ways to generate energy – and the jobs associated with them. Loan guarantees alone have financially backed $40 billion in investments for commercial clean energy projects, giving us a chance to compete and succeed in the global clean energy race,” according to the DOE.
Preparing the Energy Industries

During the current difficult economic times, the construction industry can look toward the energy sector as a bright spot on the horizon. Many of the jobs created by the energy industry are in the construction trades. Construction workers will build new power plants, develop the sites for wind and solar generation, maintain existing infrastructure, and help lay out the pipes and lines which connect resources to generators and to end users.

Construction Craft Laborers (CCLs) will use a variety of skills, tools, and equipment on energy industry jobs. Many tasks are the same as those found on building and road construction jobs – site preparation, concrete work, materials handling, pipelaying, etc. But other job tasks require additional skills and knowledge of new technologies. Some of these energy-related jobs include installers of solar panels, wind turbines, and green roofs, plus building retrofit specialists and energy auditors.

To obtain these and other energy industry skills, CCLs may need to participate in education and training programs. According to the U.S. Bureau of Labor Statistics 2010-11 Career Guide to Industries: Utilities, workers with a college education or advanced technical training will have the best opportunities.

Training and education opportunities for energy industry workers are as varied as the industry itself. For the CCL, the Laborers International Union of North America (LIUNA) offers training programs which prepare them for jobs which use and build upon their construction skills.

LIUNA Training and Education Fund (LIUNA Training) develops CCL curricula and trains instructors to teach construction craft skills at affiliated training sites located throughout North America. More than 50 different training programs in construction, environmental and residential industry specialties, and in worker safety and supervisory skills, prepare workers to meet the challenges of the growing energy industry.
Industry Skills Certification

Often a worker needs more proof of ability and knowledge than simply attending a course or training session. Government regulations and industry requirements may demand certification (independent documentation) that the worker has the skills and knowledge to perform a particular job or task. Examples include Rigger and Signal Person certification for work with cranes, Lead Abatement Worker for removing lead-based paint from buildings, and demonstrated ability to operate a rough terrain forklift. These tasks are just a few which are governed by federal regulations. Many more state and municipal laws affect the construction workforce.

Although the legal requirements can be confusing, LIUNA Training and its local affiliated training sites can unravel the tangle and make sure that workers have the credentials they need to get work in their area. This may mean taking specific courses and passing written and performance assessments. It may even mean taking a special certification examination. Whatever the requirement, LIUNA’s training programs will prepare workers for the process.

In each of the following industry-specific sections, we have identified some of the certificates which may be required to work in the energy sector. Chapter XII gives descriptions of each LIUNA Training course which applies to work in the renewable energy and energy efficiency industries. At the end of the document, we provide more information about LIUNA’s programs and why they are most suited for construction craft laborers.

You may also go online and learn about all CCL options.
www.liunatraining.org/education/curriculum/overview.cfm
II. Power Plant Transmission and Distribution

Electricity is vital for most everyday activities. Every time you flip on a light switch, you connect to a huge network of electric lines, distribution and transmission substations, and generation plants. Power plant operators control the machinery that generates electricity. Power plant distributors and dispatchers control the flow of electricity from the power plant over a network of transmission lines to industrial plants and substations, and finally, over distribution lines to residential users.

This segment of the energy market includes firms engaged in the generation, transmission, and distribution of electric power. Electric plants harness highly pressurized steam or some force of nature (such as wind) to spin the blades of a turbine, which is attached to an electric generator. Coal is the dominant fuel used to generate steam in electric power plants, followed by natural gas, petroleum, nuclear power, and other energy sources. Renewable sources of electric power include hydroelectric, geothermal, wind, and solar energy.

Legislative changes and industry competition have created new classes of firms that generate and sell electricity. Some industrial plants have their own electricity-generating facilities, capable of producing more power than they require. Those that sell their excess power to utilities or to other industrial plants are called non-utility generators (NUGs). A type of NUG, termed an independent power producer, is an electricity-generating plant designed to take advantage of both industry deregulation and the latest generating technology to compete directly with utilities for industrial and other wholesale customers. Transmission or high voltage lines supported by huge towers connect generating plants with industrial customers and substations. At substations, the electricity’s voltage is reduced and made available for household and small business use via distribution lines, which are usually carried by utility poles.

Did you know:

+ There are about 5,700 operational power plants in the United States with a nominal capacity of at least one MegaWatt. A power plant can have one or more generators, and some generators may use more than one type of fuel. (Source: U.S. Energy Information Administration)

+ There are more than 300,000 miles of high-voltage electric transmission lines across the U.S. (Source: National Energy Education Development Project)

**Transporting Electricity**

- Power plant generates electricity
- Transformer steps up voltage for transmission
- Transmission line carries electricity long distances
- Neighborhood transformer steps down voltage
- Distribution line carries electricity to house
- Transformer on pole steps down voltage before entering house
Job Opportunities

The entire electric industry is engaged in a massive overhaul, upgrading a grid that hasn’t changed in nearly half a century. Called smart grid technology, it involves installing smart meters, high voltage transmission lines, sensors and transformers. The workforce must also evolve to enable this upgrade and support our infrastructure into the future. In the transmission and distribution industries, CCLs are needed to assist in the construction and maintenance of plants and substations, digging trenches for lines and backfilling, road repair after line installation, and supporting infrastructure such as oil and gas pipelines. Typically, CCLs engage in the following types of jobs:

- Building construction
- Highway construction
- Pipelaying
- Pipeline worker
- Concrete worker
- Rough terrain forklift operator
- Scaffold builder
- Rigger and signal person
- Mason tending

Case in Point

Planned changes to the EPA’s Air Pollution Rules will create approximately 290,000 jobs in each of the next five years, according to a Ceres study conducted by Dr. James Heintz of the Political Economy Research Institute at the University of Massachusetts, Amherst. Construction jobs will realize the largest gain from capital improvements required to implement new pollution controls and new generation construction. EPA estimates that the planned FutureGen2.0 project to upgrade a power plant in Meredosia, Illinois will create 1,000 direct construction jobs. (Source: http://www.greenlaborjournal.org/articles/futuregen-s-carbon-capture-and-storage-project)
LIUNA Training Courses

LIUNA offers training and certificates in the courses listed below.

- Concrete Forming and Placing
- General Construction
- Hoisting and Rigging
- Mason Tending
- OSHA Safety Training
- Pipelaying
- Pipeline
- Rough Terrain Forklift Safe Operation and Maintenance
- Scaffold Building
- Signal Person
- Soil Compaction
- Trench and Excavation Safety

Industry Certifications

Because power plant work will focus on construction, it usually requires the same certifications as building and highway work. Nearly all construction jobs require OSHA 10-hour Construction Safety certification. Some require training and certification for Signal Persons and Load Riggers as defined under OSHA 1926 Subpart CC, Cranes and Derricks. The same is true for Rough Terrain Forklift operators and Scaffold Builders (required by some local regulations). Pipeline workers need certificates for each task covered by industry Operator Qualifications (OQ). Again, these are governed by federal requirements, 49 CFR 192 Subpart N and 49 CFR 195 Subpart G.

LIUNA provides training in all of these industry areas through local LIUNA training sites. The courses and certificates meet regulatory and industry requirements. The training itself is designed to meet the needs of the CCL by including lots of hands-on exercises and activities.

LIUNA’s training programs can also prepare workers for industry examinations and certifications provided by other commonly recognized organizations. Our concrete program prepares workers for jobs in concrete and gives them the information needed to work toward American Concrete Institute (ACI) Flatwork Finisher certification. (http://www.concrete.org/CERTIFICATION/Cert_pgminfo.asp?pgm=Concrete+Flatwork+Finisher+and+Technician)
Solar technology may sound new, but it’s been around quite some time. In 1839, French physicist Edmund Bequerel discovered that sunlight could produce electricity, known as the photoelectric effect. Knowledge of the sun’s ability to produce both heat and electricity has led to the invention of numerous technologies for capturing the sun’s energy. The most common technologies produced and used in the United States today include photovoltaics, concentrating solar power (also known as solar thermal electric) systems, solar hot water systems, and passive solar building design.

Photovoltaic (PV) cells, also known as solar cells, produce electricity directly from sunlight. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a PV cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is absorbed by the material (a semiconductor), electrons are dislodged from the material’s parent atoms. Free electrons can then travel into a circuit in the form of electricity. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface.

PV cells and modules can be made from different semiconductor materials, varying in cost and performance:

1. Crystalline silicon.
2. Thin-film, photovoltaic cell/module made from layers of semiconductor material.
3. Concentrator, which includes a reflective or refractive device to gather and concentrate sunlight onto the photovoltaic cell.

Forecast of New Photovoltaic Installation Capacity in North America (in Megawatts)

Source: IHS iSuppli Research, November 2011
PV cells can be hooked together to meet many different types of electricity requirements, from pumping water to operating calculators and watches or lighting homes and communities.

Did you know?

+ The largest PV plant in the U.S., the Copper Mountain Solar Facility in Boulder City, NV, employed more than 350 construction workers to install 775,000 solar panels.
+ Solar power is not just for desert areas. In Pittsfield, Massachusetts, a solar power facility was built on a Brownfield site (industrial contaminated property). It will produce enough energy to power 300 homes. This facility joins several other existing and planned Brownfield projects, helping to make Massachusetts one of the strongest states for solar power.

Job Opportunities

Beyond manufacturing solar panels or the research and development jobs in developing increasingly efficient solar technology, the solar industry also requires trained construction and installation workers with skills in:

+ Solar panel installation
+ Concrete placement (ground installations)
+ Highway construction (facility access)

Case in Point

In September, 2011, the DOE finalized a $646 million loan guarantee to support an innovative solar power plant designed to improve the efficiency and reliability of solar power. It was awarded to AV Solar Ranch 1, LLC to support the Antelope Valley Solar Ranch 1 Project, a 230 megawatt (MW) alternating current cadmium telluride (CdTe) thin film photovoltaic solar generation facility that will be located in Antelope Valley in North Los Angeles County, California. The project, recently acquired by Exelon Corporation, is anticipated to fund 350 construction jobs and 20 operations jobs. (Source: energy.gov)
LIUNA Training

The following LIUNA Training courses provide the skills needed to work in PV solar power facility construction and PV panel installation:

- Concrete Forming and Placement
- General Construction
- OSHA Safety Training
- Solar Panel Installation

See Section XII for course descriptions or go to www.liunatRAINing.org/education/curriculum/overview.cfm

Industry Certifications

LIUNA Training courses provide the skills and knowledge needed to work on solar installation and in construction of solar generation facilities. As with other construction jobs, most contractors will require OSHA 10-hour Safety certification. They may also want workers who are certified in concrete forming and placement to construct the base for ground-mounted solar panels. Workers will most likely need certification in solar panel installation. For example, in Nevada, solar panel installers must obtain a license by passing a state examination. Training and assessments for all of these certifications is often provided by local LIUNA training sites. Check with LIUNA Local training sites for more information on what is required in your area.

In addition, the Interstate Renewable Energy Council (IREC) develops quality and competency standards for solar and renewable energy professionals and maintains a database for Certification Organizations. (http://irecusa.org/irec-programs/workforce-development/certification-organizations/)
IV. Renewable Energy - Solar (Thermal)

In the 1830s, the British astronomer John Herschel famously used a solar thermal collector box (a device that absorbs sunlight to collect heat) to cook food during an expedition to Africa. Today, thermal energy from the sun is also used to heat water for many purposes, including heating buildings with hot water, and generating electricity by concentrating solar energy to heat a fluid and produce steam to power a generator. The three main types of solar thermal power systems are parabolic troughs and solar dishes (arrayed in solar fields) and solar power towers, a promising technology for grid-connected power plants.

Solar water heating systems for buildings typically include a solar collector, in which fluid is heated by the sun, and a storage tank, which holds the hot fluid after it has been heated by the collector. Systems using fluids other than water require the additional step of passing water through a heat exchanger to heat the water. However, the number of solar hot water systems purchased in the United States is still quite small compared to the number purchased in the rest of the world.

Did you know?
+ In April 2011, Google invested $168 million in the world’s largest solar thermal plant at the Ivanpah Solar Electric Generating System near Primm, NV. Facility construction currently employs approximately 500 union laborers.
+ An increasing number of universities are hosting solar fields due to their long-term partnership abilities. Colorado State University built the first two-megawatt system in 2010, the maximum amount allowed at the time. Expanded in December 2010, they now have 23,000 thousand solar panels and 10 inverters. The completed project totals 5.3 megawatts over 30 acres. (http://www.greenbuildingnews.com/articles/2011/02/24/university-solar-fields-on-the-rise)
The National Solar Thermal Test Facility at Sandia National Laboratories is unique – and in demand. The Facility has been instrumental in NASA tests, national defense programs and concentrated solar technology development, offering scientists access to emerging solar thermal technologies. Because of high demand, the facility has received Recovery Act funding to expand, including building a new lab, additional office space, and facilities for testing molten salt equipment and heat-powered engines. (Source: energy.gov)

Case in Point
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Job Opportunities
The growing commercial solar thermal industry requires trained construction and installation workers to build solar fields. Work includes:

- Concrete placement (for panel foundations and ancillary facilities)
- Highway construction (facility access)
- General construction
- Solar panel installation
The following LIUNA Training courses are available to help workers prepare for jobs in the solar thermal energy industry.

- Concrete Forming and Placement
- General Construction
- OSHA Safety Training
- Solar Panel Installation

See Section XII for course descriptions or go to www.liunatraining.org/education/curriculum/overview.cfm

Industry Certifications

Like the photovoltaic industry, solar thermal work will require a variety of construction skills and certifications. Because large scale facilities are often remote, they may need to have new access roads built. Workers will certainly need OSHA 10-hour Construction Safety certification. They may also need certification in Rough Terrain Forklift Operation. Some contractors may need trained and certified workers in concrete placement, and roadway line and grade. LIUNA training sites offer programs and certification in these specialties.

Certification in solar panel installation is not uniformly required by government agencies, but it has become more common. Check with Local LIUNA training sites for requirements in your area. You may also review information provided by the Interstate Renewable Energy Council (IREC) for more information on renewable energy training and certification. (http://irecusa.org/irec-programs/workforce-development/certification-organizations/)
People have been using wind energy for hundreds of years to pump water or grind grain. Today, the windmill’s modern equivalent – a wind turbine – can use the wind’s energy to generate electricity. A single small or intermediate-sized wind turbine can generate enough electricity to power a house or farm, while a number of large-scale utility wind turbines can form wind plants or wind farms that generate enough electricity for tens of thousands of homes.

The U.S. DOE Energy Efficiency & Renewable Energy program reports that in 2009 more wind generation capacity was installed in the United States than in any previous year despite difficult economic conditions. The rapid expansion of the wind industry underscores the potential for wind energy to supply 20 percent of the nation’s electricity by the year 2030 as envisioned in the 2008 Department of Energy (DOE) report 20 Percent Wind Energy by 2030: Increasing Wind Energy’s Contribution to U.S. Electricity Supply. Funding provided by DOE, the American Recovery and Reinvestment Act of 2009 (Recovery Act), and state and local initiatives have all contributed to the wind industry’s growth. In addition, states are creating strategies and policies for both on and off-shore wind farms.

New wind energy production will require many trained construction workers. Site grading, erosion control, staging area construction, turbine foundation construction (approximately 130 – 240 m³ of concrete each 1-2 MW turbine) and site access make up the bulk of the construction work. (Brookhaven National Laboratory 2004)(http://www.bnl.gov/isd/documents/26626.pdf)

For example, on the White Oak Wind Farm near McLean County, Illinois, union contractor Rachel Contracting and its subcontractors employed an average of 100 workers on site for about 50,000 man hours. At the newly constructed staging area, approximately 250,000 cubic yards of soil and 120,000 tons of aggregate base awaited use for backfill and road construction. Additional construction included a seven acre parking area for site workers. The 100 installed turbines will generate enough electricity to power 40,000 homes. (http://www.constructionequipmentguide.com/Wind-Farm-Requires-Major-Earthwork/16433/)

Did you know:
+ The United States has more than 40,000 MW of installed wind power capacity.
+ In 2010, the U.S. wind industry grew 15 percent, installing 5,115 MW of generating capacity—enough to power more than 1.2 million homes.
+ Wind power represented 25 percent of all new U.S. electric generation capacity in 2010
+ Commercial wind energy systems are currently installed in 38 states. (Source for all four: DOE Energy Efficiency & Renewable Energy Wind Program)
+ Worldwide wind power generation exceeded 250 billion kilowatt hours in 2009, equivalent to the annual electricity consumption of over 22 million average U.S. households. (Source: U.S. EIA)
Job Opportunities

The wind industry employs skilled workers in a number of different capacities. New wind projects require people with business, meteorological, soil science, and engineering experience to plan and build projects. Construction workers are needed to build the wind turbine foundations and access roads, and mechanical and electrical technicians, called windsmiths, are required to operate and maintain the wind turbines. Typical CCL jobs include:

- General construction
- Concrete placement
- Roadway construction
- Site preparation
- Erecting turbines

Source: American Wind Energy Association
Wildcat Wind Farm, a newly proposed wind energy generation project in Indiana, will include 80 to 125 wind turbines on 150 acres. The general contractor, White Construction will hire up to 150 construction workers, all through local union hiring halls. The wind farm will generate 200 megawatts of energy at a project cost of approximately $400 million. (http://midwest.construction.com/yb/mw/article.aspx?story_id=166376327)

Case in Point

LIUNA Training Courses

LIUNA Training offers the following courses to prepare workers for jobs in the wind energy field.

- Chainsaw Safety and Operation
- Concrete Forming and Placement
- Erosion Control
- General Construction
- Hoisting and Rigging
- Line and Grade and GPS/Total Station
- OSHA Safety Training plus Fall Protection
- Permit Required Confined Space
- Rough Terrain Forklift Safe Operation and Maintenance
- Signal Person
- Soil Compaction
- Trenching and Excavation Safety

See Section XII for course descriptions or go to www.liunatraining.org/education/curriculum/overview.cfm
Industry Certifications

Modern wind turbines are quite large and require space to stage and install. Furthermore, site access and preparation may be on the scale of a large construction project. Therefore, like other construction jobs in the renewable energy industry, those associated with wind energy generation require many traditional CCL skills and certifications. Concrete forming and placement will be especially important as will line and grade and GPS skills. LIUNA Training offers training programs and certification in both areas. Concrete flatwork finisher certification through the American Concrete Institute adds another level of skills recognition. (http://www.concrete.org/CERTIFICATION/Cert_pgminfo.asp?pgm=Concrete+Flatwork+Finisher+and+Technician) Workers may also need certificates in Permit Required Confined Space, Rigger and Signal Person for crane use, Rough Terrain Forklift operation and Trench and Excavation Safety.

Some specialized safety skills training and certification may also be required when working on wind turbine installation. For example, in Michigan, LIUNA members take special training to work on new and existing wind farms. All workers receive OSHA safety training; and most need confined space entry for work inside the tower and trench and excavation safety for work on utility installations. All workers also need fall protection training and some need advanced skills for working at heights. Some of the wind energy contractors require Wind Turbine Safety and Wind Farm Rescue Training certificates. The LIUNA Michigan training site provides this specialized training to meet local needs in the growing wind industry.
Geothermal energy production taps into the heat present in the earth’s subsurface rock and soil which is a constant 55 degrees Fahrenheit. Where accessible, the heat can be recovered as steam or hot water and used to heat buildings or generate electricity, or, used for pre-heating and pre-cooling HVAC systems. There are three geothermal technologies currently in use in the United States: direct-use systems, use of deep reservoirs to generate electricity, and geothermal heat pumps, used mainly for residential applications.

Geologists and drillers study the area to decide whether to recommend drilling. Geothermal reservoirs suitable for commercial use can only be discovered by drilling. First, a small-diameter “temperature gradient hole” is drilled (some only 200 feet deep, some over 4000 feet deep) with a truck-mounted rig to determine the temperatures and underground rock types. Production-sized wells require large drill rigs that can cost as much as a million dollars or more to drill. Geothermal wells can be drilled over two miles deep. On these large rigs, drilling continues around the clock.

Geothermal power plants convert hydrothermal fluids (hot water or steam) to electricity. The oldest type of geothermal power plant uses steam, accessed through deep wells, to directly drive a turbine to produce electricity. Flash steam plants are the most common type of geothermal power plants in operation today. They use extremely hot water (above 300 degrees Fahrenheit), which is pumped under high pressure to the generation equipment at the surface. The hot water is vaporized and the vapor in turn drives turbines to generate electricity. Binary-cycle geothermal power plants use moderate-temperature water (100-300 degrees Fahrenheit). The water is used to vaporize a second fluid that has a much lower boiling point than water. The vapor from this second fluid is then used to drive the turbines to produce electricity. As of March 2011, nine states currently have operating geothermal power plants: Alaska, California, Hawaii, Idaho, Nevada, New Mexico, Oregon, Utah, and Wyoming. (Geothermal Energy Association, 2011)
Case in Point

In February 2011, the DOE finalized a $96.8 million loan guarantee, supported by the Recovery Act, for U.S. Geothermal, Inc.'s project to build a major geothermal power project in southeastern Oregon. The company estimates the project, known as Neal Hot Springs, will create 150 construction jobs, more than a dozen permanent jobs and many more supply chain jobs across several states, including Texas, California and Ohio. (Source: energy.gov)

Did you know?

+ The world's largest geothermal field is in the Mayacamas Mountains in northwest California, called The Geysers. Since 1960, steam from the 45 square mile field spanning Lake and Sonoma counties has been extracted to drive turbines and generate baseload renewable electricity.
+ Former President George W. Bush has a geothermal system at his Crawford Ranch. (livescience.com)
+ According to the New York State Energy Research and Development Authority (NYSERDA), which gives money and technical help to builders who use alternative energy sources, 63 geothermal projects have been completed since its aid program began in 1999. Forty-six more projects are in the works. (livescience.com)

Job Opportunities

According to the Geothermal Energy Association (GEA), the geothermal industry has a shortage of trained industry professionals. Jobs range from degreed positions such as engineers and geologists to skilled craft workers such as the drill rig operators and welders. CCLs will find the greatest job opportunities in plant construction and pipeline installation, including:

+ Drilling
+ Welding
+ Operating backhoes
+ Operating skidsteers
+ Mixing slurry
+ Heat fusion for HDPE pipe
+ Site layout (Theodolite, Total Station, GPS)
+ Erosion control
+ Pipelaying
LIUNA Training Courses

Development of geothermal energy uses a variety of construction craft skills, and the following LIUNA Training courses provide training in many related job skills.

- Aboveground Drilling
- Chainsaw Safety and Operation
- General Construction
- Line and Grade and GPS/Total Station
- OSHA Safety Training
- Pipelaying
- Soil Compaction
- Trenching and Excavation Safety

See Section XII for course descriptions or go to www.liunatraining.org/education/curriculum/overview.cfm

Industry Certifications

In addition to the training certificates that CCLs can obtain by taking the courses listed above, specialized training may be available at local LIUNA training sites. For example, under a Green Jobs Innovation Fund Grant provided by the Department of Labor, program participants receive training in direct exchange geothermal applications. The Newburgh, New York Local 17 Training Fund and Earthlinked Technologies, conduct job skills training, which includes basic geothermal system configurations and components, special electrical and plumbing kits used to enhance the geothermal systems, proper selection of systems based on need and usage, systems start-up and troubleshooting issues. Participants also learn general construction skills and green construction applications. All training includes hands-on exercises and competency assessments.

Most geothermal companies train workers on the use of specific technologies and preferred work practices on the job. Many of these workers bring their construction skills as a solid foundation for work in the geothermal industry.
The energy stored in biomass (organic matter) is called bioenergy. People have been burning biomass, such as trees and straw, to cook and warm themselves for thousands of years. Today bioenergy from wood heats 25 million homes and produces 10.2 billion watts of electricity (less than 1 percent of what we use as a nation) from wood waste and other biomass. We also derive up to 0.4 percent of all our transportation fuels (about 1.5 billion gallons) from corn, which is used to produce ethanol.

While we have always used wood and other biomass for heat, the production of electricity and fuels has grown from virtually nothing 20 years ago to what it is today, helping bioenergy become second only to hydropower as the largest source of renewable energy in the world. In addition, we use biomass instead of petroleum to produce between 11 and 15 billion pounds of consumer products, including plastics, glues, furniture, paints, and chemicals.

Biomass power plants generally burn lumber, agricultural products or waste, or construction/demolition wood wastes – usually cogenerated with other resources such as coal. Energy generation – usually on a small scale – includes anaerobic digestion or capture of methane-rich gas from the breakdown of organic matter. Landfill gas (LFG) recovery already generates energy from hundreds of plants located throughout the United States.

As bioenergy technologies and bio-based products stand poised to help the U.S. achieve energy independence, the conversion of biomass into fuels and products still remains more difficult than the processes used for petroleum or coal. If R&D and industrial efforts succeed in making bioenergy more commercially profitable, we may see a dramatic increase in the number of bioenergy-related jobs.
In 2005, a project to convert an abandoned brewery in upstate New York to an Ethanol-producing plant was announced. The project was projected to create 300 construction jobs along with 100 jobs operating the plant, and 1,000 spin-off jobs in agriculture and transportation. The plant was bought by Sunoco in 2009 and operates today with 68 employees.

**Case in Point**

In 2005, a project to convert an abandoned brewery in upstate New York to an Ethanol-producing plant was announced. The project was projected to create 300 construction jobs along with 100 jobs operating the plant, and 1,000 spin-off jobs in agriculture and transportation. The plant was bought by Sunoco in 2009 and operates today with 68 employees. (DOE, 2011)

**Did you know?**

+ Under the American Recovery and Reinvestment Act (ARRA), two major landfill gas electricity generation plants were approved for funding. One in Orange County, CA expects to produce enough to power 20,000 homes. The second plant, in Johnston, RI, is of similar size and when finished will be the largest renewable generator in the state. These projects expect to employ more than 100 construction workers each during the building process. (DOE, 2011)

**Job Opportunities**

Engineers and construction workers are needed to design and build bioenergy plants, while electrical/electronic and mechanical technicians, engineers (mechanical, electrical, and chemical), mechanics, and equipment operators are needed to run and maintain these plants. Some may even require individuals cross-trained in areas such as engineering and biology, or chemistry and agriculture. Jobs in bioenergy today cut across a wide spectrum of specialties and skills.

Construction workers - One of the goals of the U.S. Department of Energy’s Biomass Program is to foster a domestic bio-refinery industry modeled after petrochemical refineries. Most of these refineries have yet to be built. Electric generation from bio-sources is also expected to grow. In both industries, CCLs will be needed during the construction phase and may also be involved in plant maintenance. CCLs may perform jobs in:

+ General construction
+ Site preparation
+ Concrete and asphalt work
+ Mason tending
+ Pipelaying
+ Welding
+ Material handling
+ Maintenance
LIUNA Training Courses

The following LIUNA Training courses help CCLs learn the skills needed to work in the bio-energy industry:

- Aboveground Drilling
- Asphalt
- Blasting Awareness
- Chainsaw Safety and Operation
- Concrete Forming and Placing
- Cutting and Burning
- General Construction
- Hazard Communication
- Hoisting and Rigging
- Line and Grade and GPS/Total Station
- Mason Tending
- OSHA Safety Training
- Permit Required Confined Space
- Pipelaying
- Process Safety Management
- Rough Terrain Forklift Safe Operation and Maintenance
- Scaffold Building
- Shielded Metal Arc Welding (SMAW)
- Signal Person
- Soil Compaction
- Trenching and Excavation Safety

Industry Certifications

LIUNA offers certificates for the courses listed above. All meet government regulatory requirement and industry standards. Several are widely required on most construction sites (OSHA 10 Construction Safety, Rough Terrain Forklift Operation, Signal Person and Rigger). Some may also lead to more specialized industry certificates. For example, Cutting and Burning and Shielded Metal Arc Welding training will help prepare a CCL to enter the American Welding Society’s Certified Welder program. (http://www.aws.org/certification/CW/)

LIUNA Training’s concrete program prepares workers for jobs in concrete and gives them the information needed to work toward American Concrete Institute (ACI) certification. ACI offers certification in Concrete Flatwork Finisher and other industry specialties. (http://www.concrete.org/CERTIFICATION/Cert_pgminfo.asp?pgm=Concrete+Flatwork+Finisher+and+Technician)
VIII. Renewable Energy - Hydropower

According to the U.S. Energy Information Administration, in 2009 renewables accounted for eight percent of energy consumption. Of the renewable energy consumed, hydropower accounted for 35 percent, while solar, geothermal and wind added up to ten percent. Biomass accounted for 50 percent of renewable energy consumption, due mostly to an increase in production capacity. (http://www.eia.gov/cneaf/alternate/page/renew_energy_consump/rea_prereport.html)

Did you know?
+ Only 2,400 of the 80,000 dams in the U.S. generate electric power.
+ U.S. hydropower facilities generate enough electricity to power 28 million homes.
+ Energy from the ocean waves could supply 260 terawatt-hours of electricity per year for the United States.

Most hydropower projects use a dam and a reservoir to retain water from a river. When the stored water is released, it passes through and rotates turbines, which spin generators to produce electricity. Water stored in a reservoir can be accessed quickly during times when the demand for electricity is high. Other hydropower plants, called “run of the river” projects, do not require dams. Instead, a portion of a river’s water is diverted into a canal or pipe to spin turbines.

Other less common forms of hydropower make use of ocean energy – the tides and waves. Very few places have the right characteristics to generate electricity from tidal power and the building expense is high. Wave power offers some potential, but there are currently no large commercial wave energy plants.

Many large-scale dam projects have been criticized for altering wildlife habitats, impeding fish migration, and affecting water quality and flow patterns. As a result of increased environmental regulation, the National Hydropower Association forecasts a decline in hydropower use through 2020. Nevertheless, in West Virginia, a new hydroelectric power plant is under construction at the Willow Island Locks and Dam. During the construction phase, the plant will generate 400 jobs. The trend for future hydro-power activity in the U.S. will likely be to build small-scale plants for single community use or to upgrade existing hydroelectric plants to increase output.
Job Opportunities

As with many of the other renewable energy technologies, the design, construction, and maintenance of hydropower plants require electrical and mechanical engineers, technicians, and skilled trade workers. In addition, state and federal licensing laws require hydropower plant developers to assess the environmental effects of their operation. Thus, the hydropower industry must employ environmental scientists (biologists, hydrologists, ecologists, and wildlife habitat specialists, for example) to address environmental concerns.

CCLs will find opportunities in the expansion and maintenance of plants. All building construction jobs will be available on these projects. If a new hydropower plant reaches the construction phase, CCLs will be required at all stages of construction and will find a variety of jobs ranging from site preparation, access road construction, and various building construction activities. Some CCL work on hydropower jobs includes:

- Above ground drilling
- Concrete and asphalt placement
- General construction
- Mason tending
- Material handling
- Pipelaying
- Site preparation
- Welding

Case in Point

In 2011, U.S. Department Energy and U.S. Department of the Interior announced nearly $17 million in funding over the next three years for research and development projects to advance hydropower technology, awarded to 16 projects in 11 different states, increasing the need for construction workers on the test sites.
Industry Certifications

CCL work on hydropower plant expansions, upgrades, and development will center on building construction skills. Currently, only a few certifications are required for CCLs on these jobs. Usually all workers must have taken OSHA Construction Safety. Other certificates that may be required include Permit Required Confined Space, Rigger, Signal Person, and Rough Terrain Forklift Operation. LIUNA’s training sites provide these and other courses to workers who need to acquire the skills and knowledge needed to obtain CCL work on hydropower jobs.

LIUNA Training Courses

The following LIUNA Training courses provide the skills needed to work in the hydropower sector:

+ Aboveground Drilling
+ Asphalt Placement
+ Blasting Awareness
+ Chainsaw Safety and Operation
+ Concrete Forming and Placing
+ Cutting and Burning
+ General Construction
+ Hazard Communication
+ Hoisting and Rigging
+ Line and Grade and GPS/Total Station
+ Mason Tending
+ OSHA Safety Training
+ Permit Required Confined Space
+ Pipelaying
+ Process Safety Management
+ Rough Terrain Forklift Safe Operation and Maintenance
+ Scaffold Building
+ Shielded Metal Arc Welding (SMAW)
+ Signal Person
+ Soil Compaction
+ Trenching and Excavation Safety

See Section XII for course descriptions or go to www.liunat raining.org/education/curriculum/overview.cfm
Natural gas, a clear odorless gas, is found underground often near or associated with crude oil reserves. More recently, natural gas from shale formations has opened up new options for domestic power supplies. Once natural gas is found and brought to the surface, it is transported by gas transmission companies using pressurized pipelines. Local distribution companies take natural gas from the pipeline, depressurize it, add odor, and operate the system that delivers the gas from transmission pipelines to industrial, residential, and commercial customers. Industrial customers, such as chemical and paper manufacturing firms, account for more than a third of natural gas consumption. Residential customers, electric utilities, and commercial businesses – such as hospitals and restaurants – account for most of the remaining consumption.

**Did you know?**

+ In 2009, nearly 51 percent of all households (residential sector) used natural gas as their primary heating fuel, accounting for about 21 percent of total natural gas consumed in the United States. (U.S. Energy Information Administration)

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**U.S. Natural Gas Use by Sector**

Source: Energy Information Administration
Job Opportunities

The natural gas industry employs engineers, geoscientists, multi-skilled maintenance professionals, process and production operators, pipeline workers, and health and safety professionals. CCLs will find opportunities in natural gas pipeline construction and the construction and maintenance of natural gas fueled power plants.

While other construction has dropped during the economic down turn, natural gas pipeline construction experienced a healthy market. Growth is expected to continue, especially in the northeastern U.S. where gas from the Marcellus Shale Basin will be distributed. Jobs in pipeline construction should grow over the next several years. According to the Interstate Natural Gas Association of America, approximately 60,000 miles of gas pipeline will be constructed over the next 25 years. In addition, new gas fueled power plant construction may create jobs in building construction. Some of the types of work that CCLs will find in the natural gas industry include:

- Concrete and asphalt placement
- General construction
- Mason tending
- Material handling
- Pipelaying
- Pipeline
- Site preparation
- Welding

Case in Point

In the fall of 2011, construction began on a new fuel cell based power plant on the campus of Central Connecticut State University. The plant will use natural gas for fuel to generate electricity via an electrochemical reaction. The electricity and steam generated by the plant will be sold to the university under a long term power purchase agreement. The plant is expected to be operational by December 2011. (Source: power-eng.com – Power Engineering magazine)
LIUNA Training Courses

LIUNA training sites offer the following courses and other skills training to prepare workers for jobs related to natural gas distribution and power generation:

+ Above Ground Drilling
+ Back Injury Prevention
+ Blasting Awareness
+ Chainsaw Safety and Operation
+ Concrete Forming and Placing
+ Erosion Control
+ General Construction
+ Hoisting and Rigging
+ Line and Grade and GPS/Total Station
+ OSHA Safety Training
+ Pipeline
+ Rough Terrain Forklift Safe Operation and Maintenance
+ Signal Person
+ Soil Compaction
+ Trenching and Excavation Safety

See Section XII for course descriptions or go to www.liunatraining.org/education/curriculum/overview.cfm

Industry certifications

Industry skills certification for CCL jobs in natural gas depends on the industry sector. Pipeline jobs require Operator Qualifications (OQ) certification for a variety of tasks. LIUNA Training works directly with pipeline contractors to develop and provide training programs which meet OQ training and testing requirements. For construction of power plants, CCLs will need a variety of construction skills. Some job tasks can only be assigned to certified or trained workers. These include rigging and signal persons, rough terrain forklift operation, and in some locations, scaffold building. Most jobsites require all construction workers to take the OSHA Construction Safety course.
X. Traditional Energy - Nuclear

Power plants that generate electricity from nuclear energy are similar in structure to plants that use fossil fuels (coal, oil, natural gas) as an energy source. At all power plants except hydroelectric, high pressure steam moves the propeller-like blades of a turbine; this spins the shaft of a huge generator. Inside the generator, a coil of wire spins a magnetic field to create electricity. The heat needed to boil water into steam in a power plant is produced either by burning coal, oil, or natural gas in a furnace, a chemical process, or by splitting atoms of uranium in a nuclear reactor, a physical process.

Nuclear fission does not involve burning or explosions. Rather, the uranium fuel – tons of it – generates heat through a process called fission. These plants do not produce electricity through nuclear explosions and the electricity is not radioactive. In fact, the nuclear fuel used in a commercial nuclear power plant cannot explode.

The uranium used as a fuel in a nuclear plant is formed into ceramic pellets about the size of the end of your little finger. These pellets are inserted into long, vertical tubes within the reactor core. As uranium atoms in these pellets are struck by atom particles, they split – or fission – to release particles of their own. These particles – called neutrons – strike other uranium atoms, splitting them. This sequence of fission – splitting one atom which triggers others, and those triggering still more – is called a chain reaction. When the atoms split, they also release heat. This heat is known as nuclear energy.

The action inside the reactor is controlled by rods inserted among the tubes holding the uranium fuel. These control rods are made of a material that absorbs neutrons and prevents them from hitting atoms that can fission. In this way, the nuclear reaction can be sped up or slowed down by varying the number of control rods withdrawn and how much they are withdrawn.

### Energy Sector Changes: New Power Capacity

New investment in power generation, million kw gross capacity, 2010-2030

![Energy Sector Changes Chart]

- **With Carbon Capture and Sequestration (CCS)**
- **Without Carbon Capture and Sequestration (CCS)**

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>With CCS</th>
<th>Without CCS</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Natural Gas</td>
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<td>53.7</td>
</tr>
<tr>
<td>Coal</td>
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<td>77.9</td>
</tr>
<tr>
<td>Nuclear</td>
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<td></td>
</tr>
<tr>
<td>Renewables</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Did you know?

+ The U.S. is the world’s largest producer of nuclear power, accounting for more than 30 percent of worldwide nuclear generation of electricity.
+ The country’s 104 nuclear reactors at 65 commercially operated nuclear power plants produced 807 billion kWh in 2010, over 20 percent of total electrical output. (Source: World Nuclear Association)

The lengthy permitting process for nuclear power plants severely limits construction in new locations. However, several new plants have recently been approved for development on existing nuclear power generation sites. If final permits for these plants are approved, local construction work will be plentiful. Individuals can expect work in nearly all areas of construction, especially concrete and materials handling.

Case in Point

Plant Vogtle, located in Burke County, GA, is currently under construction. This $14 billion construction project is the first nuclear reactor to be built in the U.S. in 30 years. The addition of new jobs has kept public controversy to a minimum, as employment projections reach 3,500 construction jobs and 800 permanent positions in a struggling rural area of Georgia. New nuclear plants are also planned for existing nuclear facilities, including the South Texas Project Electric Generating Station and the Calvert Cliffs plant in Maryland.

Other jobs in the nuclear industry are more common and cyclic in nature. These are associated with the necessary plant “outages.” An outage is a temporary shutdown, which is required for regular maintenance, refueling and repairs. These happen approximately every 18 months at any plant, and as stated earlier, there are 103 operating nuclear power plants in the U.S.

During an outage, CCLs conduct a variety of tasks. Some radiological remediation and shielding work is needed, so all workers must have approved Radiological Worker training. Other general construction and maintenance jobs also provide work opportunities during an outage.
**Job Opportunities**

Engineers and construction workers are needed to design and build nuclear plants while electrical/electronic and mechanical technicians, engineers (mechanical, electrical, and chemical), mechanics, and equipment operators are needed to run and maintain these plants. Jobs in nuclear plants cut across a wide spectrum of specialties and skills. CCLs will find opportunities in plant construction and maintenance, including some of the following job tasks:

- Concrete and asphalt placement
- General construction
- Hazardous waste and radiological cleanup
- Mason tending
- Materials handling
- Pipelaying
- Plant maintenance
- Scaffold building
- Site preparation
- Welding

**Case in Point**

Though demand for nuclear power has softened in America, at present, the Nuclear Regulatory Commission anticipates future projects may involve new light-water reactor (LWR) facilities in a variety of projected locations throughout the United States. (Source: nrc.org)
LIUNA Training Courses

Construction work on new nuclear power plants will include a broad range of activities and require many different skilled workers. Work on nuclear plant outages may require many of the same skills that are needed in plant construction, but it also requires Radiological Worker training. The following LIUNA Training courses help prepare workers for jobs in nuclear power.

- Above Ground Drilling
- Asphalt
- Blasting Awareness
- Chainsaw Safety and Operation
- Concrete Forming and Placing
- Cutting and Burning
- General Construction
- Hazard Communication
- Hazardous Waste Worker
- Hoisting and Rigging
- Line and Grade and GPS/Total Station
- Mason Tending
- Nuclear Power Plant
- OSHA Construction Safety Training
- Permit Required Confined Space
- Pipelaying
- Process Safety Management
- Radiological Worker
- Rough Terrain Forklift Safe Operation and Maintenance
- Scaffold Building
- Shielded Metal Arc Welding (SMAW)
- Signal Person
- Soil Compaction
- Trenching and Excavation Safety
- Tunnel and Shaft

Industry Certifications

Perhaps the most important certificate needed for nuclear power plant work is Radiological Worker. CCLs must understand the dangers of working around radiation, radioactive materials or in areas that could have radiological contamination. Safety, personal protection, and monitoring are key components of this training. Other relevant certifications include Hazard Communication, Hoisting and Rigging, Signal Person, Scaffold Builder, and Rough Terrain Forklift Operation. Of course, most jobs also require that construction workers have taken the OSHA Construction Safety Training. LIUNA training sites offer these certificates and more.
XI. Going Green

Trends toward using energy more efficiently and preserving our natural resources also generate job opportunities. And not just in the energy sector but in the overall construction sector as well. Green construction jobs – weatherization, building retrofit, pollution prevention, erosion control, LEED building construction, deconstruction, and others environmental jobs – require construction craft laborers to handle at least a portion of the tasks required to get the job done.

In fact, a Booz Allen Hamilton study released by the U.S. Green Building Council (USGBC) at Greenbuild 2009 predicted green building would support or create 7.9 million jobs between 2009 and 2013, and will contribute $554 billion to the U.S. gross domestic product.

In addition, a 2011 study by the Brookings Institution revealed today’s clean energy economy already employs some 2.7 million workers across a diverse array of industries.

[source: Energy.gov]

**Did you know?**

+ The U.S. Green Building Council reviewed an upcoming McGraw-Hill Construction report on green jobs which concluded that “training is essential for getting and maintaining green jobs; 30 percent of green workers say they needed additional training when they started and most report that formal education and training programs will continue to be needed. Hiring firms agree: 71 percent of hiring decision makers maintain that being credentialed increases competitiveness.” 

[source: Energy.gov]

The clean energy economy, as defined by The Pew Charitable Trusts, is an economy that “generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources.”

[source: pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf]
The Pew report identified five groupings of the clean energy economy in which the U.S. will likely see job growth.

1. **Clean energy**: Building sustainable energy for the future will provide new construction jobs. Construction craft workers will build new plants; electricians, engineers and plumbers will install building systems; plant operators and researchers will maintain facilities and improve how we store and distribute energy.

2. **Energy Efficiency**: Reducing and managing our energy demand means making existing buildings more energy efficient and using new energy saving technologies in construction. Work in energy efficiency involves reducing use of fossil fuels in the short term and using less energy in the long term. Engineers could develop new products that help reduce and monitor energy use; while other jobs would be created in the installation of those products. CCLs will work on weatherization and retrofit, deconstruction and green construction, and energy auditing.

3. **Environmentally Friendly Production**: Improving our products and processes to mitigate harmful environmental impacts and supply alternatives that require less energy. There are six job areas: transportation, manufacturing, construction, agriculture, energy production and materials. Construction jobs could include workers who produce and install green building material such as pervious concrete and manufactured products made from scraps and recycled materials, and consultants who provide green building design and construction services.

4. **Conservation and Pollution Mitigation**: Recycling and remediating waste. This includes jobs and businesses involved in water and natural resource management, recycling, and remediation of waste. Trained CCLs will continue to find jobs in hazardous materials handling and remediation of contaminated buildings and property. Remediation jobs include hazardous waste, lead, asbestos, biological, and other hazardous materials cleanup and removal. It may also involve construction skills to prepare the site and demolition, deconstruction, or renovation work.

5. **Training and Support**: Helping develop our clean energy technology. These jobs might include green financial investment experts, researchers and engineers, and teachers – such as LIUNA trainers – to train new workers for the clean energy economy.

**Case in Point**

Using ARRA support, the U.S. DOE helped generate demand for residential weatherization and energy efficiency. As of June 2010, more than 108,000 homes were weatherized under ARRA, supporting more than 10,000 jobs. Growth in the industry has provided job opportunities for LIUNA members throughout the country. (http://www.recovery.gov/News/press/Pages/20100618_DOE_Weatherization.aspx)
LIUNA Training Courses

Clean energy and green construction work require most of the same skill sets that construction laborers need for building construction jobs. Workers may need additional training in environmentally-friendly work practices and installation of new materials. Acquiring specialty skills will open up more opportunities for a CCL. LIUNA Training offers the following courses to help CCLs qualify for new green jobs.

+ Green Construction
  - Introduction to Green Construction
  - LEED for Supervisors
  - Green Roof Installation
  - Solar Panel Installation

+ Recycling and waste remediation
  - Asbestos Abatement
  - Lead Abatement
  - Hazardous Waste Worker
  - Demolition Deconstruction

+ Smart irrigation systems installation
  - Pipelaying,
  - Trenchless Technology

+ Weatherization and Renovation
  - Weatherization Technician Installer
  - Weatherization Supervisor
  - Energy Auditor
  - Lead Renovator
  - Infection Risk Control Assessment (ICRA)

Other training programs that are under development and will soon be available include:
  + Construction Waste Management
  + Erosion Control
  + Green Landscaping
  + Storm Water Control
Industry Certifications

As a construction industry sector, clean energy and green construction are relatively new but they use most of the same work skills. Government regulations guide training and certification for many of these jobs, especially those related to environmental remediation. In some instances, accepted industry standards guide certification. LIUNA training offers training and certification which meets current and proposed government and industry criteria in the following:

+ Asbestos, Lead, and Hazardous Waste Worker
+ Concrete Worker
+ Energy Auditor
+ Rigger and Signal Person
+ Rough Terrain Forklift Operator
+ Scaffold Builder
+ Weatherization Supervisor
+ Weatherization Technician/Installer
XII. LIUNA Training Course Offerings for Energy and Green Construction Jobs

LIUNA Training has curriculum and instructor training available in a wide variety of construction and environmental skills. Construction Craft Laborers and Apprentices can take these courses through their LIUNA Local training centers. For descriptions of other courses and to locate a training center near you, visit the LIUNA Training website at www.liunatraining.org. The following courses prepare workers for a variety of jobs in the energy and green construction industries:

**Asbestos Abatement** – prepares CCLs to work safely and productively on asbestos abatement projects. Participants receive extensive instruction and hands-on training on work area preparation, decontamination facility construction and use, abatement techniques, and cleanup procedures. Special emphasis is placed on following proper procedures and developing safe work habits.

**Aboveground Drilling** – introduces CCLs to the unique working environment of aboveground drilling by providing instructor facilitated classroom instruction along with intensive, performance-based, hands-on training. The care and use of tools and equipment are presented, as well as drilling techniques. Basic information about rocks and their composition and characteristics are introduced, as drillers must know how geology affects the drilling process. The personal safety of CCLs working on a drilling site is reviewed in depth. Site safety, hazard communication, health hazards, personal protective equipment, and working around explosives are also covered.

**Asphalt** – provides hands-on training in the placement, spreading, raking, and compaction of asphalt materials. Also covered are safety issues when working with asphalt, such as burns, fumes and chemicals, and heat stress. CCLs are introduced to the properties, uses, and mix designs of asphalt and the equipment and tools used in paving operations. Placement methods are discussed in detail, as well as repair and patching, and cleanup and maintenance. Additionally, participants learn how to perform some of the calculations and estimates necessary to successfully perform the duties of an asphalt laborer. Participants should have a good understanding of basic construction math for this program.

**Back Injury Prevention** – teaches participants how to avoid back injuries and steps to take to maintain a healthy back. Focuses on using correct techniques for lifting, shoveling, and other work activities.

**Blasting Awareness** – prepares CCLs to work around or with a licensed blaster. Topics covered include all safety concerns when working with, transporting, or using blasting materials. Classifications of explosives, loading charges, warning signals, and safe handling of misfires are also covered.
Chainsaw Safety and Operation – prepares CCLs to safely operate and maintain a chainsaw. Participants receive instruction on how a chainsaw works, its parts, and how to maintain a chainsaw in a safe and efficient operating order. Participants also receive instruction on the safe operation of the chainsaw, including the proper PPE to wear, how to safely make a variety of cuts in logs and standing timber, and how to safely fell trees. There is ample opportunity for hands-on practice with the chainsaw.

Concrete Forming and Placing – prepares CCLs to work safely and productively on concrete jobs. Safety issues associated with the mixing, forming, placement, and curing of concrete materials as well as the associated skills are covered in depth. Through instructor facilitated and extensive hands-on training, a CCL becomes familiar with construction math and measurements, project planning, and site preparation. Other topics covered in detail include appropriate cleanup procedures, concrete sawing and concrete repair.

Cutting and Burning – teaches participants how to safely cut metal in a shop or field setting using cutting and burning tools. Topics covered include fire safety, including fire watch procedures; knowledge and use of oxyfuel cutting systems, with emphasis on oxyacetylene style systems, but also including oxy-gasoline systems; and knowledge and use of a plasma arc cutting system. Participants have ample time for hands-on training and practice.

Demolition/Deconstruction – prepares CCLs to enter the field of Demolition/Deconstruction. Interactive classroom and hands-on activities help participants learn about the many safety issues associated with Demolition/Deconstruction work, how the work is performed, the types of equipment used, the similarities and differences between demolition and deconstruction, and how to complete some basic tasks associated with site control and deconstruction.

Energy Auditor – teaches individuals to calculate energy efficiency needs of a structure and to determine the best procedures and materials to use to increase that efficiency. Topics covered include diagnostic equipment, conducting an audit, measurement selection, and work scope development.

General Construction – introduces participants to a wide variety of concepts, tools, and skills that are important to successfully begin a career as a CCL. Participants receive instruction on laborers’ work and their role on a construction job. The course also covers commonly encountered safety issues, measurement in construction, safe hand and power tool operation, and materials frequently used in construction. Several topics require students to perform tasks or demonstrate skills being taught. Special emphasis is placed on following proper procedures and developing safe work habits.

Green Roof Installation – prepares CCLs to install green roofs. Interactive classroom and hands-on training is used to help participants learn about the safety issues involved with installing green roofs, green roof classifications, green roof plans, components and soils, plant types and landscaping techniques used for green roofs.

Hazard Communication – introduces CCLs to the Occupational Safety and Health (OSHA) Hazard Communication Standard, as it applies to the construction industry. Training focuses on the guidelines for recognizing and protecting oneself from exposure to hazardous substances, including identifying chemical hazards and the proper use of container labels, placards, and material safety data sheets.
Hazardous Waste Worker – prepares CCLs to work safely and productively on hazardous waste remediation projects. The program meets all Occupational Safety and Health Administration (OSHA) training requirements under 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response.

Hoisting and Rigging – designed to educate CCLs in the rules, processes, and procedures to safely rig, signal, and hoist loads on construction projects. The program incorporates federal and state regulatory requirements as well as equipment manufacturers’ standards. Knowledge of the regulations, as well as an in-depth understanding of equipment, work procedures, techniques, and safety considerations is essential for CCLs to function in a zero-accident environment. The program combines classroom instruction with hands-on exercises to ensure competency.

Introduction to Construction Supervision – examines the general duties and responsibilities of the project supervisor. CCLs are instructed on the different roles construction supervisors play on projects, including pre-job responsibilities, their role in managing the project, and general responsibilities for ensuring that the project is completed safely, on time, and within budget. In addition, the program covers the interpersonal skills successful supervisors must possess in order to serve as effective leaders.

Intro to Green Construction – helps CCLs prepare to work on a green building project. Participants learn what “green” means and its importance to the environment. They also learn about different green rating systems, with an extensive focus on the LEED rating system and the impact this has on the way jobs are run, and the day-to-day activities of CCLs.

Layout – Line and Grade and GPS/Total Station - focuses on the skills, knowledge, and aptitude necessary to operate a variety of surveying instruments and record information for maintaining elevation and alignment control points on heavy and civil construction projects.

Lead Abatement – prepares CCLs to work safely and productively on lead abatement projects. The course meets all Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) training requirements under 29 CFR Part 1926.62 and 40 CFR Part 745.225 respectively. The course is mandatory for all workers conducting lead-based paint activities in target housing and child-occupied facilities.

Lead Renovator – prepares participants to perform renovation work using lead safe work practices. It meets all EPA and OSHA training requirements under 40 CFR Part 745.225 and 29 CFR Part 1926.62. Lead Renovator is mandatory for all workers conducting lead-based paint activities in target housing and child-occupied facilities. Topics covered include history of lead in paint, health hazards of lead, lead regulations, pre-renovation considerations, dust containment, personal protective equipment, work practices, final cleanup procedures, recordkeeping and training non-certified renovation workers.

LEED for Supervisors – prepares CCLs to become supervisors on a green building job. Participants learn about the different types of green building rating systems in use today, the LEED rating system for new construction and major renovation, how the LEED registration and certification process works, the financial impact of building green, and how to stay current with green building innovations, code changes and regulations.
Mason Tending – provides instruction on the mason tender’s duties, proper job task performance, and details the health and safety issues associated with mason tending. Participants use mathematical and scientific concepts to achieve an understanding of how to estimate the correct amount of masonry units needed, as well as the correct amount of mortars and admixtures that will be used to place the units. The fundamentals of cutting and cleaning masonry and tending plasterers are also covered. The program emphasizes the need for executing each job task safely and correctly.

Microbial Remediation – instructs CCLs on the health hazards, personal protective equipment requirements, and remediation processes and techniques associated with the removal of mold as well as other microbial contamination.

Nuclear Power Plant – designed for CCLs involved in the maintenance and shutdown activities at nuclear power plants or whose job assignments involve unescorted entry into areas controlled for radiological purposes. This program is divided into nine topics, which focus on the theory, basic radiological fundamentals, and the terms CCLs must know to work safely around radiological hazards.

OSHA Safety Training including Fall Protection – designed to meet the requirements for OSHA’s 10-hour and 30-hour training programs. The program provides safety and health information as it relates to the many hazards found on construction projects and offers insight into their mitigation.

Permit Required Confined Space – focuses on the identification of the different types of confined spaces as well as their associated hazards. Participants receive detailed instruction on rules, regulations, and procedures to be followed when entering a confined space as well as methods to mitigate the associated hazards.

Pipelaying – prepares CCLs to safely install pipe systems by introducing participants to the tools, equipment, and techniques typically used in pipelaying. Participants also learn about proper work practices and protective measures to follow when installing a variety of piping systems.

Pipeline – prepares CCLs to safely and productively work on a pipeline project. Participants learn about the hazards involved with pipeline work and how to avoid them. They also learn about all the different jobs that a CCL does on a pipeline. Training includes ample opportunity for hands-on practice of skills they will need to work on a pipeline, including building fences, protecting and applying coating, moving pipe, setting skids and more.

Pipeline Operator Qualifications – designed to certify participants as qualified according to Operator Qualification (OQ) standards for testing/evaluation of specific tasks performed by pipeline workers. The course prepares workers to qualify in the covered tasks associated with pipeline work, including but not limited to; setting line markers, inspecting pipe for damage, protecting pipe from hazards, excavating, backfilling, applying coating, coating maintenance, installing cathodic protection systems, and monitoring for corrosion.
Pneumatic Tools Usage – prepares CCLs to use and maintain some basic pneumatic tools. Interactive and hands-on activities help participants learn the safety issues associated with pneumatic tool use, identify different types of pneumatic tools and their use, and how to use and maintain these tools and the compressors that power them.

Process Safety Management – prepares participants to work in an industrial setting where chemicals and petroleum products are stored and distributed throughout the plant. Participants learn about OSHA’s Process Safety Management Standard, where it applies, and how it is applied.

Radiological Worker – designed for CCLs involved in the cleanup of radiological contaminated waste sites or whose job assignments involve unescorted entry into areas controlled for radiological purposes. This program is divided into seven topics which focus on the theory, basic radiological fundamentals, and the terms CCLs must know to work safely around radiological hazards.

Rough Terrain Forklift Safe Operation and Maintenance – a 16 hour course designed for CCLs who need training to operate a Rough Terrain Forklift (RTF) as required under OSHA’s Powered Industrial Truck standard. CCLs learn how to inspect, operate, and maintain forklifts used on construction sites. The LIUNA RTF training meets OSHA requirements by providing both classroom information and operational skills training. This activity-based training helps students understand the machinery’s capabilities and hazards and teaches them safety precautions that make them better RTF operators.

Scaffold Building – addresses the needs of CCLs that are responsible for building scaffolding on the job site or are required to perform job tasks while using scaffolding. Designed to meet the training requirements of OSHA safety regulations, 29 CFR Part 1926.454, the comprehensive program covers erection and use of several different types of scaffolding including: frame, tube and coupler, system, non-powered adjustable and powered adjustable scaffolding. The program also includes participant discussion, interactive exercises, and extensive hands-on training.

Shielded Metal Arc Welding (SMAW) – prepares CCLs to perform basic welding operations. Intensive interactive classroom and hands-on training includes identifying and controlling the hazards associated with welding, the basics of electricity, proper set up, selection and use of welding equipment, and welding techniques.

Signal Person – prepares workers to be qualified signalers on jobs that require the use of cranes to hoist and move construction materials. The course provides an overview of a signal person’s duties and responsibilities and includes instruction in the proper techniques for giving voice commands and hand signals. It also covers rigging basics and crane safety to ensure that the qualified worker understands hoisting and rigging procedures that may affect the signal person’s actions and responsibilities. The LIUNA Training Signal Person course meets the revised OSHA 1926 Subpart CC standards for signal person qualification.
Soil Compaction – prepares CCLs to work safely and productively to properly compact soil and fill material which serves as a base for roadways, concrete slabs, and other structures such as power plants and substations. Participants learn to use and maintain a variety of equipment, including vibratory plate compactors, rolling compactors, and ramming compactors. Special attention is paid to producing a subsurface that is adequately compacted to support the load that will be placed upon it.

Solar Panel Installation – prepares CCLs to work safely and productively while installing solar panels in various scenarios. Through instructor facilitated and extensive hands-on training, CCLs become familiar with the principals of solar thermal and photovoltaic systems, the safety hazards involved with installing these systems, as well as installing panels on the ground, on a commercial building (flat roof), and on a residential building (pitched roof).

Trenching and Excavation Safety – designed to meet the requirements of OSHA’s 29 CFR Part 1926, Subpart P. Participants learn about the hazards of working in trenches and excavations and how to stay safe. Topics include sloping and benching the trench, and installing and using various types of trench protection including trench boxes, hydraulic shoring, and timber shoring.

Trenchless Technology – prepares CCLs to work with the new technology that has been recently developed to inspect and repair pipe without excavating it. Includes instruction in remote camera use and various procedures used to repair or refurbish existing pipe such as liner installation and pipe bursting and replacement.

Weatherization Technician/Installer Lead Abatement – prepares workers to make homes more energy efficient by minimizing energy loss. The program addresses safety issues, provides an understanding of the basic tools and techniques of the trade, and trains workers in weatherization techniques. Topics covered include building science, sealing the building envelope, insulating and sealing ductwork, and installing insulation.

Weatherization Supervisor – teaches qualified individuals the skills and knowledge needed to be a successful supervisor of a weatherization crew. Topics covered include diagnostic testing, combustion appliance safety and testing, and inspection and monitoring.
Energy demand isn’t slowing any time soon. Research to discover cleaner, more cost-efficient energy sources continues to reveal exciting findings; and pressure to reduce dependence on foreign sources continues to increase. It all adds up to great opportunities for CCLs trained in the skills the energy sector demands.

LIUNA Training and Education Fund has the experience and training capacity to respond to the needs of workers and contractors. Here CCLs will find the rigorous hands-on skills training they need to better position themselves for the jobs of the future and to advance their careers. Employers will find an invaluable resource: a highly-trained workforce that helps them succeed.

About LIUNA Training

LIUNA Training and Education Fund is an independently accredited developer of CCL and supervisor training programs, offering the best adult education for the construction workforce. Our training programs address the needs of today’s CCLs and supervisors by focusing on the skills, aptitude, and knowledge necessary to perform safely and productively on construction and environmental remediation projects. All LIUNA Training programs incorporate learner-centered, activity-based lessons with rigorous hands-on and classroom training that exceeds construction industry standards.

We offer our courses through 70 affiliated training centers located throughout the United States and Canada. Each year, roughly 140,000 LIUNA members attend our training in a wide range of topics: building construction; heavy and highway construction; construction supervision; environmental remediation, demolition, rehabilitation and restoration. We continually update our curricula to reflect evolving needs, most recently adding courses on green construction and demolition/deconstruction. By opening the door to opportunity, we help apprentices and journey workers improve and add to their skills, advance their careers and gain a competitive advantage in a tough marketplace.

What’s more, our programs are independently accredited, which ensures that both staff and students work up to the highest independent standards practiced in the construction trade and education profession. Industry and professional credentials include:

+ International Accreditation Service (IAS) independent accreditation of our trade curriculum and instructor training program.
+ Government accreditation or trade certification in industry specialties.
+ American Council on Education (ACE) recommendation of our programs for college credit eligibility.

Our commitment to quality guarantees our graduates will have the rigorous hands-on training needed to get the job done right. Because ultimately, the greatest value of our training lies in the end product: quality construction safely and expertly completed by skilled craft workers.
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Appendix: Training Centers MAP

State, local, and provincial training requirements and job qualifications may vary. All LIUNA training sites can work with LIUNA Training and local agencies to identify needs and provide appropriate curriculum and training for CCLs to meet job specifications. To contact one of our local training centers visit our website at www.liunatraining.org.